
WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
MATERIALS CONTROL, SOILS AND TESTING DIVISION

MATERIALS PROCEDURE

CHEMICAL DETERMINATION OF CEMENT CONTENT IN HARDENED CONCRETE

- 1.0 PURPOSE
- 1.1 To set forth a procedure for determining the cement content of hardened concrete by a chemical method.
- 2.0 APPLICABLE DOCUMENTS
- 2.1 Highway Research Record, Number 370, 1971.
- 2.2 American Society for Testing and Materials, C-127.
- 3.0 PROCEDURE
- 3.1 Bulk Specific Gravity (ASTM Method C-127 with adaption for concrete saturated surface dried basis).
- 3.1.1 A sample of the concrete approximately three times the size of the largest aggregate used in the concrete mix is dried to constant weight at $105^{\circ} \text{C} \pm 2^{\circ} \text{C}$. After soaking for 24 hours, the sample is surface dried and weighed in air, then weighed in water.
- 3.2 Free Water Loss
- 3.2.1 The sample from 3.1.1 is dried in an oven for 24 hours at $105^{\circ} \text{C} \pm 2^{\circ} \text{C}$. The sample is cooled in a desiccator and weighed.
- 3.3 Combined Water Loss
- 3.3.1 The sample from 3.2.1 is crushed and pulverized to $850 \mu\text{m}$. The sample is split to approximately 100 grams.

3.3.2 Approximately 50 grams of sample are accurately weighed on an analytical balance. The sample is placed into a weighed dish and dried at $600^{\circ}\text{C} \pm 10^{\circ}\text{C}$ for four (4) hours. The sample is then cooled in a desiccator and weighed.

3.4 Extractable Matter

3.4.1 Approximately 10 grams of sample are accurately weighed on an analytical balance. To the sample is added 400 milliliters of 20% maleic acid (dissolved in anhydrous methanol). The sample is stirred for ten (10) minutes. The sample is decanted through a previously weighed set of filter papers in a Buchner funnel, one paper should be fast filtering, the other slow filtering. To the residue in the beaker is added an additional 200 milliliters of the maleic acid solution. The sample is stirred for ten (10) minutes, then washed into the filtering funnel. The funnel is carefully washed with methanol to remove the maleic acid from the paper. The residue is dried for ten (10) minutes at $105^{\circ}\text{C} \pm 2^{\circ}\text{C}$, cooled in a desiccator, and weighed.

4.0 CALCULATIONS

4.1 Bulk Specific Gravity (ssd)

$$\text{Sp. Gr.} = \frac{A}{A-B}$$

Where A = weight in grams of saturated surface dried sample in air.
 B = weight in grams of saturated sample in water.

4.2 Free Water Loss (percent)

$$\text{Lf} = \frac{A-C}{A} \times 100$$

Where C = weight in grams of sample after 24 hours at 105°C (ssd).

4.3 Combined Water Loss (percent)

$$L_c = \frac{D-E}{D} \times 100$$

Where D = Weight in grams of sample
E = Weight in grams after heating at 600°C.

4.4 Extractable Matter (percent)

$$M_E = \frac{F-G}{F} \times 100$$

Where: F = Sample weight in grams
G = Weight of residue in grams

4.5 Residue

$$R = 100 - M_E$$

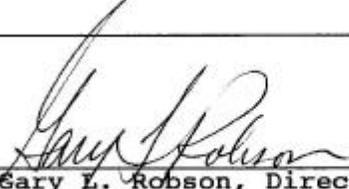
4.6 Cement Percentage

$$C_p = (100 - R - L_c) \left(\frac{1 - L_f}{100} \right)$$

4.7 Cement Content in bags/m³

$$cc = \frac{(C_p) (1) (Sp. Gr.) (K)}{(100) (42.64)}$$

Where K = 997.05


Gary L. Robson, Director
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